

Advanced Spacecraft Navigation and Timing Using Celestial Gamma-Ray Sources, Phase I

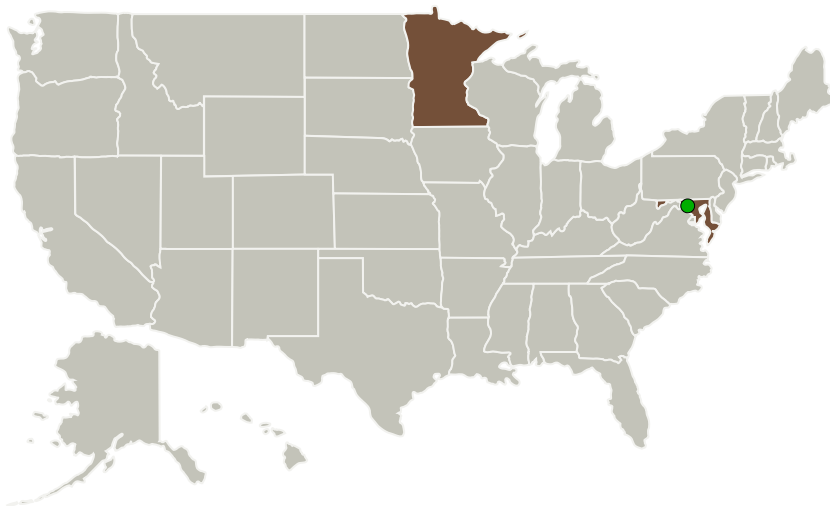
Completed Technology Project (2012 - 2012)



Project Introduction

The proposed novel program will use measurements of the high-energy photon output from gamma-ray celestial sources to design a new, unique navigation system. This Gamma-ray source Localization-Induced Navigation and Timing, or "GLINT", concept provides deep-space vehicles the capability for self-navigation based upon measurements from observations of these source signals. In the past, gamma-ray sources have been coarsely localized on the sky. The Swift mission now provides high-precision source localizations, allowing the potential inversion of the differential timing problem to independently constrain the positions of spacecraft with gamma-ray detection equipment. A comprehensive study is proposed of the necessary characteristics for navigation of the high-energy ($E_{\text{photon}} > 20 \text{ keV}$) celestial sources and the associated detectors used to collect their signal, detailed development of the algorithms and filters used to process the source signals and vehicle trajectory data, architecture design of an operational system, and an assessment of the potential performance and benefits directly for future deep-space exploration missions. Both on-board self-navigation techniques and post-processed techniques will be studied. Extensive simulation incorporating existing source observational data and orbit trajectory programs, including publicly available NASA software tools will provide a basis for our analysis and performance assessment.

Primary U.S. Work Locations and Key Partners



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Organizations Performing Work	Role	Type	Location
ASTER Labs, Inc.	Lead Organization	Industry Small Disadvantaged Business (SDB)	Shoreview, Minnesota
● Goddard Space Flight Center(GSFC)	Supporting Organization	NASA Center	Greenbelt, Maryland

Primary U.S. Work Locations

Maryland	Minnesota
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Project Transitions

▶ **February 2012:** Project Start

✓ **August 2012:** Closed out

Closeout Documentation:

- Final Summary Chart(<https://techport.nasa.gov/file/137971>)

Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Organization:

ASTER Labs, Inc.

Responsible Program:

Small Business Innovation Research/Small Business Tech Transfer

Project Management

Program Director:

Jason L Kessler

Program Manager:

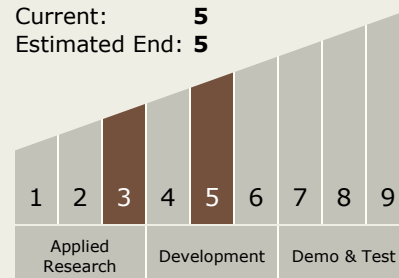
Carlos Torrez

Principal Investigator:

Suneel I Sheikh

Technology Maturity (TRL)

Start: 3
Current: 5
Estimated End: 5



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Technology Areas

Primary:

- TX05 Communications, Navigation, and Orbital Debris Tracking and Characterization Systems
 - └ TX05.4 Network Provided Position, Navigation, and Timing
 - └ TX05.4.2 Revolutionary Position, Navigation, and Timing Technologies

Target Destinations

The Sun, Earth, The Moon, Mars, Others Inside the Solar System, Outside the Solar System